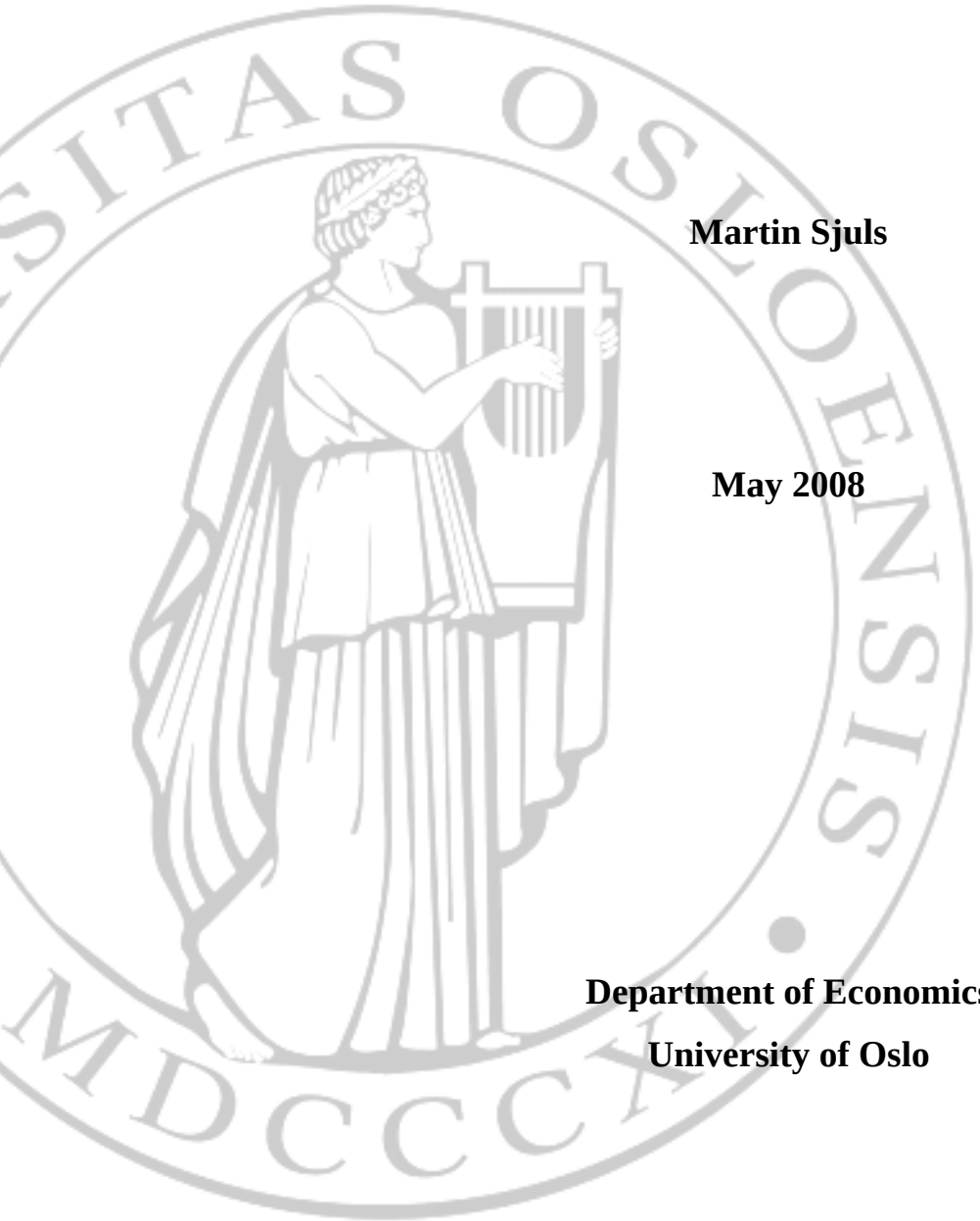
Master thesis for the Master of Philosophy in Economics degree

Demand for Norwegian Premiership Football

The Impact of Public Broadcasting of Games



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Preface

"Football is a game for 22 people that run around, play the ball, and one referee who makes a slew of mistakes, and in the end Germany always wins" – Gary Lineker

There are numerous approaches to the world's most popular sport. My approach has been an instructive process. It has challenged me in using economic theory on a field I earlier only had a passionate relationship to.

The final result would not have been possible without constructive and encouraging comments from my supervisor post doc. Jon H. Fiva at the Department of Economics. Thank you!

Chris Worsfold deserves thanks for proofreading the thesis and giving useful comments. The discussions about the sport we love have improved this thesis.

I would never have been able to accomplish a master degree without my good friends and fellow students at the University of Oslo. They have made my life as student an unforgettable time, and I will miss the totally off topic discussions we had in the fourth floor.

Last, but not least I am grateful to mom and dad who have always supported me and provided me with extraordinary housing facilities during my life as student in Oslo.

All potential errors or misunderstandings are in the responsibility of me and only me.

Blindern. May 2008

Martin

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1. Introduction

"Understanding about the nature and determinants of demand is arguably the most important empirical issue in analysis of professional sporting markets. Team owners and managers, sporting league administrators, and public policy-makers or regulators simply cannot make correct judgements on issues of vital importance to them, without having some knowledge about demand." (Borland and MacDonald, 2003)

Norwegian premiership football has apparently never experienced more popularity like the popularity we have seen the last couple of years. Never has so much money been involved in the sport and the clubs can be considered as medium sized firms with some having budgets higher than 100 million NOK. The income from ticket sale is an important revenue source, implying that knowledge about the demand for the sport is of vital importance. Even though "demand for sport" studies have been common practice in sporting leagues abroad, there are few contributions on this field in Norway. Johnsen and Solvoll (2007) analyse however in their article the demand for televised football. They examine the TV-ratings and how they are influenced by factors specific to television on the one hand and factors specific to football on the other hand.

This thesis seeks to answer how the demand for Norwegian premiership football is affected by live televising of games on a public broadcaster. The televising of games in Norway is unique in respect to the number of games which are broadcasted live. The result of a 1 billion NOK media contract effective from the 2006 season was that all games in the premiership were broadcasted live either on public television or on subscription TV. Watching football for free can be viewed as a substitute to attend the match at the arena, and one should therefore expect that public broadcasting reduces attendance on those matches.

In my analysis I make use of detailed match specific data from the 2006 and 2007 season to control for potentially other determinants of the attendance. These data capture economic variables, uncertainty variables, quality of viewing variables etc. The method used is a fixed effect regression analysis, implying that both observable and unobservable fixed characteristics of the home teams the respective seasons are accounted for. The analysis has been carried out in the program package PcGive10.

Carrying out an analysis on demand for sport, four key methodological challenges must be addressed. First, like in all empirical work one needs to obtain good data. As there is no complete data set for my purpose, I have used data from different sources in the creation of a suitable data set. Second, there are challenges related to the quality of measurement of variables. This is especially the case on uncertainty variables, which is heavily discussed among sport economists. Third, there are potential problems of omitted variable bias. As there are many observable and unobservable determinants of demand, and the relationships are complex, caution must be expressed when analysing the results. To avoid that unobservable determinants of demand create spurious relationship between live broadcasting and attendance, this analysis include a battery of fixed effects. Fourth, capacity constraints make it difficult to measure demand. This is however not of great concern in this study as the proportion of sold out stadium is relatively small.

I find no evidences that public broadcasting of games reduces attendance significantly. The results show rather a weak positive influence on attendance when matches are broadcasted on the largest public broadcaster TV2. That people attend matches just because they are televised sounds unreasonable. Both the theory and the data build up on the hypothesis that the broadcaster makes no random choice of which games to televise. Their preferences are very much like the preferences of the supporters. The broadcaster is also interested in stadiums which are crowded and has a good atmosphere. That creates better television, implying higher TV ratings and more income from the advertisers. Furthermore, there is reasonable to believe that the broadcaster's advertise for the game they broadcast, also acts as advertising for the game itself and increases attendance.

The lack of demand for football studies in Norway is somewhat surprising as the popularity apparently has risen to a level where not even the sky seems to be logical limit. In the following I give in chapter (2) some background information about the Norwegian premiership division, *Tippeligaen*, and its rising popularity. I also briefly present the economics of sport and the media. Their interdependence resulted in 2005 in a historical TV-agreement, which I also shortly present. In chapter (3) I outline the economic theory on the demand for sport. This is based on general demand theory. Then I will discuss the factors which might have an impact on the demand, including the impact of televised games. The discussion is based on the existing literature which I also present. I chapter (4) I go through

the data set and how the data are obtained. Chapter (5) presents the model used and the methodological framework. I also comment the descriptive statistics in this section. I examine the results of my econometric analysis in chapter (6) and discuss the final results. A conclusion is given in chapter (7).

2. Background

2.1 Tippeligaen

Tippeligaen is the name of the top division of professional football in Norway. It consists of 14 teams, which are competing to be the league champions. The league starts normally in the month of April and ends in the beginning of November. The teams play against each other twice a season, one home game and one away game. Thus, each team play 26 matches in a season that totally consists of 182 matches. A victory gives the winning team three points, a draw gives each team one point and a loss gives zero points. The team with most points after the 26 rounds is the league champion. The two bottom teams are regulated to the 1.division (also referred to as Adeccoligaen), while the two first teams in the 1.division are promoted to Tippeligaen. The twelfth place in Tippeligaen and number three in Adeccoligaen meet each other in a play off match (home and away) to decide which team to play the next season in the top division.

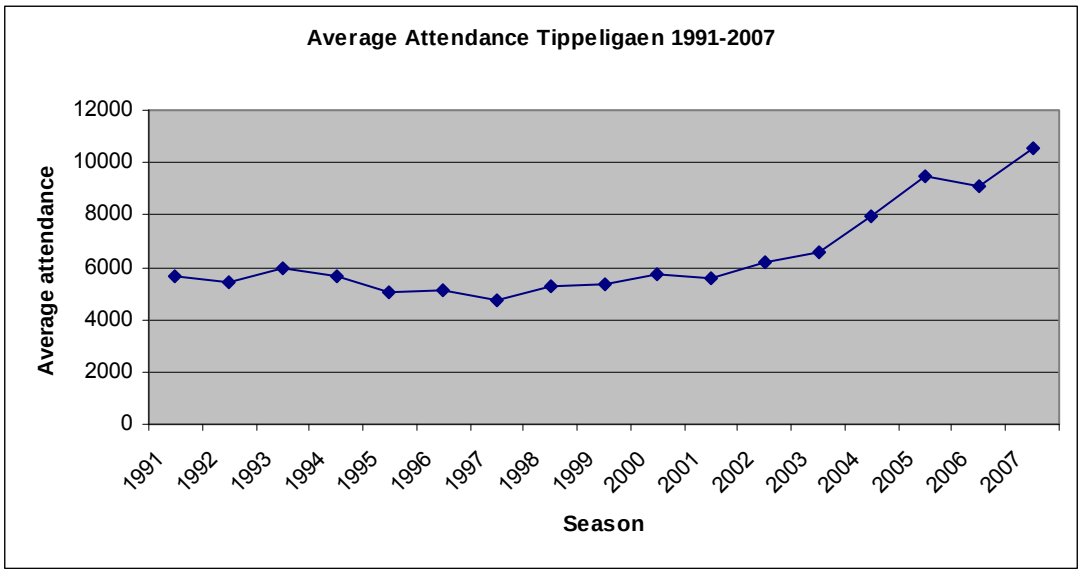
Top division football has a long tradition in Norway. The first league tournament started up for real in 1937. It was divided into two regional leagues with eight teams each, where each regions winner met each other in a final. Clubs from northern part of Norway did not have the opportunity to take part in the league at this time. From 1963 the league tournament took the form as we know it today. The top division then consisted of ten teams competing for the championship. Clubs from northern Norway was still not allowed to participate. The region entered first the top division in 1972 when the league extended to 12 teams. The number of teams was held fixed until 1994, when the league extended to 14 teams (Goksøyr and Olstad, 2002).

The popularity of *Tippeligaen* has the last ten fifteen years risen dramatically. The popularity of football in general has always been relatively strong in Norway, but due to the national team and Rosenborg's success in the 90's, football has in many ways become the new national sport in Norway. The national team played their second and third world cup in 1994 and 1998, respectively. This was the first time since 1932 they took part in the tournament. Rosenborg experienced year after year from the mid 90's success in the UEFA Champions

League.[1] Rosenborg continued their European success into the new millennium, while the national team last participated in an international tournament in the European Championship in 2000.

Rosenborg dominated the domestic league by winning 13 championships in a row during the seasons 1992 to 2004. Vålerenga broke their domination by winning the league in 2005. This was a sign that competitive balance was brought the back into Norwegian football which can be argued further has increased the popularity. Media has also played an important role in the boost for Norwegian football. Figure 1 below shows the attendance development since the first season of Tippeligaen in 1991. While the average attendance was between 5 000 and 6 000 in the 90's the attendance started to rise in the new millennium. In 2007 the average attendance passed 10 000 for the first time.

Figure1



2.2 The Economics of Sport and the Media

2.2.1 The Relationship Sport and Media

The relationship between sport and media is close. Television rights are the main source of income for many sports, and sport is important to attract television audiences. Considering first the sport's dependence for media, the media is not only an important factor to generate direct income through sales of broadcasting rights. Media coverage also raises the sport's profile, which generates interest among the public and sponsors. From media's point of view

[1] UEFA Champions League is a tournament between the best clubs in Europe.

sport is a valuable commodity and the money television companies spend on sports has increased rapidly the last decades. A convenient example should be what the American television company CBS has paid for the rights to the Summer Olympics. For the Moscow games in 1980 they paid $88 million, but to the Athens games 2004 the price had risen to $1493 million (Jeanrenaud and Késenne, 2006).[2] Popular team sports are important for the broadcasters because it raises advertising money. Among a considerable proportion of the viewers, other entertainment or conventional programs are not a good substitute for the most popular sport programs. Thus, advertising on other programs also is a bad substitute for advertising on sport programs (Noll, 2007).

An important reason why the rights have risen substantially in price the last decades is the structural change of the market. Up to the middle of the 1980s each European country had a public broadcaster and a sport federation. From that on there was a liberalisation and the governments around in Europe allowed private companies to produce television. There also was a dramatic change in technology. Free to air television was the dominant platform until the beginning of the 1980s. Today there are a number of platforms and delivery mechanisms the right owners can chose to use (Jeanrenaud and Késenne, 2006). Noll (2007) has pointed out three phenomena which occurred as a result of the growth in commercial television and television became more competitive:

> (1) A shift of sports rights from public to commercial television
> (2) An increase in the fees for sports rights
> (3) An increase in sport coverage
>
> (Noll, 2007)

Looking at the case of Norway we definitely see the same as in rest of Europe. In 1980 when NRK still was a state run monopoly company the Norwegian Football Association (NFF) earned 1 million NOK each year selling media rights. This had risen to 40 million NOK in 1998 when NRK and TV2 cooperated in broadcasting Tippeligaen (Gaustad, 2000). Considering the amount of broadcasters, TVNorge and TV3 were the two channels which first broke the monopoly of NRK starting up with regular programs in the late 1980s. In 1989 TVNorge made their first agreement with NFF which allowed them to show recorded matches from Tippeligaen and highlights from international football outside the Norwegian season. The big fights of the TV rights was in any case between NRK and TV2, which started regular

[2] The authors do not consider the fact that the USA boycotted the Moscow games.

programs in 1992 (Helland and Ytre-Arne, 2007). From 1994 to 2005 the two broadcasting companies did however share, through different agreements, the rights of broadcasting Tippeliga football. NFF also has an interest in selling the rights to one of or both of these actors. The two broadcasters can both reach the broadest audience which is important to sustain and increase the popularity of the sport. Jeanrenaud and Késenne (2006) explicitly say:

> The Federations know – or ought to know – that it is in their interest to maintain a wide audience in order to guarantee the future popularity of the sports that they represent. For this reason, rights do not always go to the highest bidder. (Jeanrenaud and Késenne, 2006)

2.2.2 Individual versus Collective Sale of Rights

In Norway the sale of the rights to Tippeligaen are centralized, implying that NFF is the actor that sells the TV rights. The Norwegian Competition Authorities (Konkurransetilsynet) has criticized NFF that this is likely to be forbidden by the competition law. The rights namely belong to both NFF and the clubs playing in Tippeligaen.[3] Under individual sale of TV rights, the TV-companies negotiate with each single club to broadcast the respective club's home games, while collective sale of TV rights implies that the league as a whole negotiates with the companies. Under the collective sale system the revenues from the sale of rights are allocated between the clubs subject to a sharing rule. Both types of sale are to be found in the respective European football leagues (Falconieri et al, 2004).

There are arguments in favour and against the respective policies on sales of TV rights, and it is hard to make a strong conclusion on whether rights should be sold collectively or individually. In the long run, however, it seems profitable to have a collectively sale of rights, mainly because of the competitive balance argument. Increasing differences in the clubs' financial situation disturb the competitive balance in European football (Groot, 2008). A sale of TV rights policy which makes these differences larger should not be argued for. This is also in line with what Andreff and Bourg (2006) conclude. They have looked at the five major leagues in Europe, the French, German, English, Spanish and Italian league, where the two latter ones, in contrast to the three first ones, have individual sale of rights. They argue that the competitive balance is significantly lower in Spain and Italy, but that their teams perform

[3] KonkurranseNytt December 2004: "Vil ha dialog med fotballforbundet om salg av TV rettigheter".– an information paper from the Norwegian Competition Authorities

better in the European cups, because of their financial advantage in respect to sale of TV rights.

2.2.3 Free-to-Air or Pay-TV?

As mentioned above there has been a rapid development in the broadcasting technology, implying that the broadcaster can chose different platforms when broadcasting their programs. The development has also leaded to the opportunity to exclude viewers by charging payment for watching a channel or a program; subscription- or pay per view based broadcasting. Obviously broadcasting sport is then not a pure public good, since the non-excludable assumption vanishes. The non-rivalry assumption is however still valid; a viewer watching a game does not prevent other viewers watching the same game. The non-rivalry property of the good represents a market failure, because what the consumers have to pay exceeds the marginal cost, which is zero. Thus, free to air television seems to prevent such a welfare loss. Another argument of market failure related to pricing mechanism must then however be taken into account. The free to air broadcasters, which cover their costs through tax and advertising, namely have less knowledge about viewers' preferences than pay-TV broadcasters, which can use price discrimination and bundling strategies. It is hard to see which market failure which creates the largest welfare loss. A pay-TV ban, implying that sport broadcasting have to be financed through advertising, is however likely to generate less income for the broadcaster. (Jeanrenaud and Késenne, 2006).

There are other economic and political arguments in the discussion on free-to-air versus pay-TV. The EU argues that televised sport creates positive externalities through stronger cultural identities and should therefore be broadcasted free to air (Jeanrenaud and Késenne, 2006). Since the today's broadcasting technology is relatively new, sport has traditionally been broadcasted on a free-to-air broadcaster. When these sport events now are moved over to pay-TV this also violate to what viewers are used to and expect. Paying for an event they always have watched for free seems wrong. Trond Giske, the minister of culture in Norway, is clear in his statement and expresses that politicians have a responsibility to prevent a situation where the consumers to a larger extent have to buy big sport experiences.[4]

[4] VG: "Vil at TV-fotball vises gratis" http://www.vg.no/nyheter/innenriks/artikkel.php?artid=108643 downloaded 07.04.2008

2.2.4 The Historical TV-Agreement

June 17th 2005 is a historical day in the history of the broadcasting of Tippeligaen. On that date the TV2 Group in cooperation with the telecom company Telenor signed a TV-agreement with the owner of Tippeligaen, NFF. The TV-deal got a lot of attention because of its high value. The price was a result of competition between national and international actors in the media market. The TV2 Group and Telenor paid 1 billion NOK to the rights of almost all Norwegian football. The agreement included the exclusive rights to broadcast the Norwegian male top division the next three years (2006, 2007 and 2008) (Helland and Ytre-Arne, 2007).

Beside the historical high price of the TV-rights, the TV-agreement is remarkable because of the wide coverage of football. This is also remarkable from an international perspective: all matches are covered live, either on the commercial public channels TV2 and TV2Zebra or on subscription-TV. The two first channels are free to air channels. The subscription-TV, provided by the TV2 Group and Telenor, viewers are excluded by a charge of payment. The subscription channel had almost 20 000 subscribers the first season (2006), while the number more than doubled during the next season.[5] As the subscribers usually can choose between four matches played at the same time, a match on the subscription channel does not have a large audience in front of the television. The audience is also relatively small, considering that about 98 per cent of the households which have television in Norway are able to receive TV2.[6] The games televised on TV2 had on average over 500 000 viewers.[7] The proportion able to receive TV2Zebra increased from about 47 per cent in the beginning of the 2006 season to about 65 per cent at end of the 2007 season.[8] The average number of viewers on the matches broadcasted TV2Zebra also increased from about 120 000 to 140 000 the two season analysed.

As a rule of thumb five matches were played Sundays at 18:00 in 2006. One of these matches was broadcasted on TV2Zebra, the rest were broadcasted on subscription-TV. At 20:00 the same day "the main match" of the round was played and broadcasted on TV2. The last match of the round was played Mondays at 19:00 and broadcasted on TV2Zebra. The fixtures were

[5]Kampanje: "Traff målet med betal-tv-fotball" http://www.kampanje.com/medier/article164121.ece downloaded 20.04.2008
[6] 98 per cent of the households have television in Norway
[7] Birgit Eie, researcher in the market division in the TV2 Group, on e-mail 11.02.2008
[8] TNS Gallup: http://tv-research.tns-gallup.no/Kanaldistribusjon/Distribusjon.asp downloaded 28.03.2008

almost following the same pattern in 2007, except that one match on subscription-TV was moved from Sunday at 18:00 to Saturdays at 19:00. Due to public holidays and delayed matches both years, some rounds and matches were played other times than scheduled above. Moreover, the matches in the two last rounds both years were played at the same time to prevent speculation between the competing teams.

The income from the agreement is shared among the different actors subject to a complex sharing model. First the income is shared between NFF and NTF. The part received by NTF is then divided such that 80 per cent goes to Tippeligaen and 20 per cent to the division below, Adeccoligaen. The sharing rule in Tippeligaen is revised every year. In 2007 the following sharing model was used: 50 per cent of the sum is shared equal between the competing clubs, 20 per cent is performance based subject to the final position in the league and the last 30 per cent depends on which channel or platform the game is broadcasted. TV2 is weighted with 60 per cent and TVZebra and subscription-TV is weighted with 20 per cent each. The home team receives 2/3, while the visiting team receives 1/3. There is also put some weight on how many who actually view the game on television, the TV-rating.[9] This implies that a televised game on TV2 can generate up to 600 000 NOK for the home team and 400 000 NOK for the away team.[10] Assuming an average admission price of 175 NOK per person, the transfer to the home team then corresponds to the loss of gate revenue from almost 3 500 spectators. Due to the complicated sharing model there is however difficult to say in general how much revenue a public broadcasted game generates for the involved clubs.

The decision of which game to broadcast each round is a result of cooperation between three actors: TV2, NFF and NTF. There are no doubts that TV2, who has paid for the television rights, is dominant in those negotiations. The channel's sport editor Bjørn Taalesen mentions four points which are of importance in the decision of which games to broadcast:[11]

- Journalistic principles concerning which game that has the largest common interest, excitement etc.
- Considerations in respect to the sport: who are in the championship race and who are fighting against relegation?

[9] Knut Kristvang, director of TV and Media in NFF, on e-mail January 22nd 2008.
[10] Dagbladet: "TIL og Stabæk mot tap i TV krigen" http://www.dagbladet.no/sport/2007/09/18/512428.html downloaded 23.04.08
[11] Bjørn Taalesen, sport editor TV2, on e-mail March 10th 2008

- Arena - attendance (Matches on TV with high attendance are much better than matches with half full stadiums).
- The round's "biggest game" shall be broadcasted on TV2

Johnsen and Solvoll (2007) argue that the public service broadcasters will maximize their audience. Since the majority of the viewers are club neutral, there is reasonable to believe that they rather want to watch games between teams that perform on a high level. The authors therefore assume that public service channels base their selection of games on sporting criterion rather than other criterions, for example criterions related to the clubs. Although the pattern is clearer in 2006, looking at the relationship between the amount of TV-coverage per team and the final league position in 2006 and 2007 respectively, we see that the top position teams get a wider coverage than the middle and low position teams (figure 2, figure 3).

Figure2

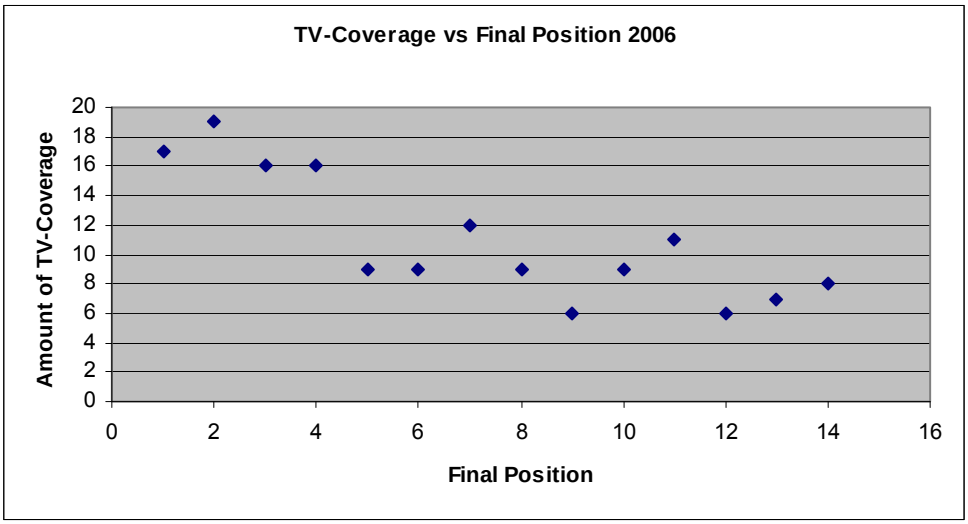
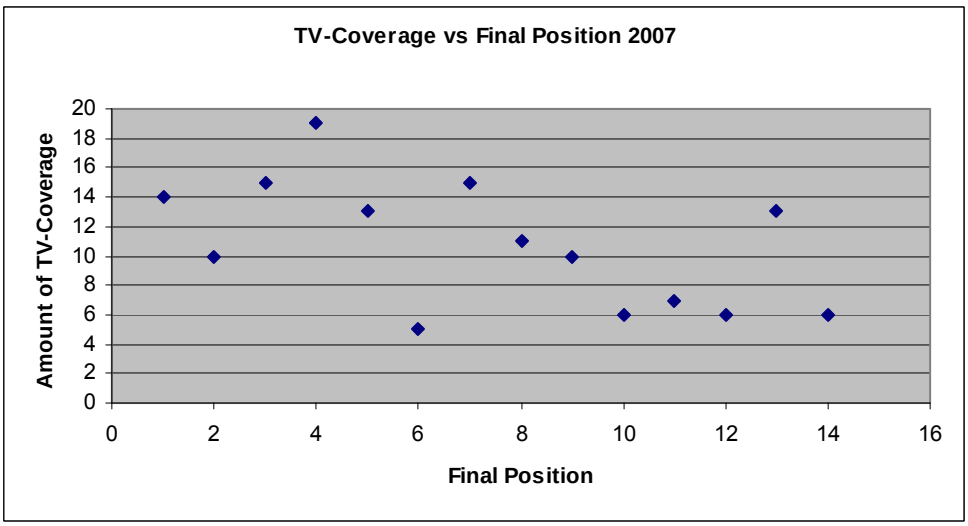


Figure3



3. Theory

This chapter briefly presents the economic theory on demand in general, and the demand for sport in particular. The economic literature on this field has developed and increased rapidly over the last decades. I also present some of the literature in this section.

3.1 Two Types of Demand

In the discussion of demand for professional sports it is convenient to distinguish between two types of demand. Using the terminology of Borland and MacDonald (2003) those two types can be called *direct* demand and *derived* demand, respectively. Direct demand refers to the attendance that shows up at the contest and the demand for watching sporting contest on a pay per view basis. The latter one refers to when the sporting contest is an intermediate good used as an input in other goods or services. The focus in this thesis will be on direct demand. The discussion above about sport and the media, can however also been seen as a part of the derived demand concept.

3.2 General Theory

The existing studies on demand for sport are based on a standard consumer theory model. That implies the assumption of the utility maximising, rational, income constrained individual consumer (Downward and Dawson, 2000).

3.2.1 Consumer Theory

The basic idea behind the consumer theory is that a rational consumer always will choose the most preferred bundle of goods from a set of affordable alternatives. In the model presented let m be a fixed amount of money available to the consumer and let $\mathbf{p} = (p_1, \cdots, p_k)$ be a vector of prices of goods. The consumer is constrained by his budget constraint, implying that he cannot get whatever he wants. His budget set is given by:

$$B = \{\mathbf{x} \text{ in } X : \mathbf{px} = m.\}$$

Formally the consumer's maximization problem can then be represented as follows:

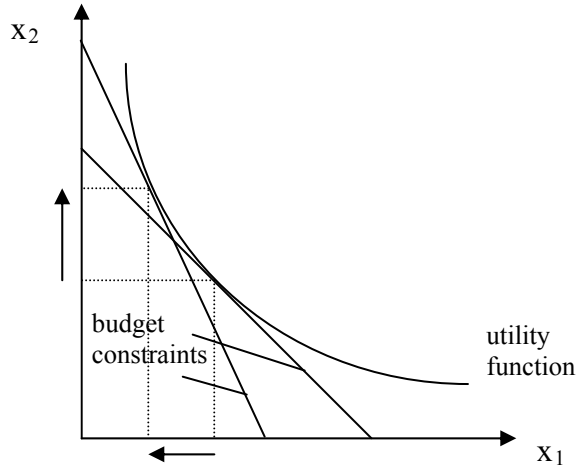
$$\begin{aligned} &\max u(\mathbf{x}) \\ &\text{such that } \mathbf{px} \leq m \\ &\mathbf{x} \text{ is in } X \end{aligned}$$

*u(***x***)* is the consumer's utility function and it is assumed to be convex, reflecting the assumption of decreasing marginal utility.[12] By standard assumptions of a continuous utility function and a closed and bounded constraint set, there will be a solution to this problem. There is also convenient to assume that the preferences satisfy local non-satiation, implying that we can restate to problem as:

$$\max u(\mathbf{x})$$
$$\text{such that } \mathbf{px} = m$$

The solution **x*** to this problem is the consumer's demand bundle. It can be represented in a figure where we for simplicity reasons assume that we have two goods, $\mathbf{x} = (x_1, x_2)$.

Figure 4



The consumer maximizes his utility when the utility function is tangent to the budget constraint (Varian, 1992). In the model x_1 represent the good football, while x_2 represent the sum of all other goods. An increase in prices on football, *ceteris paribus*, implies a steeper budget constraint and less consumption of football.

Having the theory in mind, the admission price for a game is expected to affect the attendance. Assuming that live football is an ordinary good, an increase in prices will decrease the attendance. Most studies support that the admission price has this impact on the attendance. There are difficulties, however, in measuring the price and this may alter the result in an analysis. The clubs normally operate with different price categories: season tickets, short side vs. long side stand, lower vs. upper tier, standing section, membership

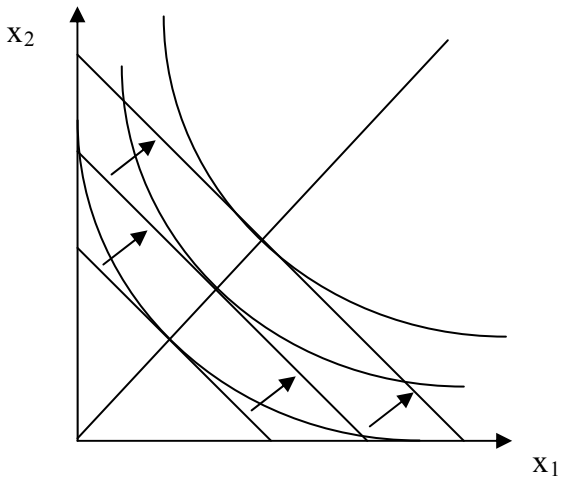
[12] By perfect substitutes or complements the utility function is assumed to be straight lines or L-shaped, respectively.

reduction etc. It is hard to find a proper way to implement all these categories in a demand model, especially when the price categories differ between the clubs. In their study of the English Premier League Baimbridge et al. (1996) use for example "the average price derived from unweighted nominal tickets prices for each game together with season tickets prices, weighted in relation to the number of such tickets". They find that ticket price has a significant negative impact on attendance, but they point out that previous studies have both resulted in positive and negative influences on the attendance using this price variable.

3.2.2 Normal versus Inferior Good

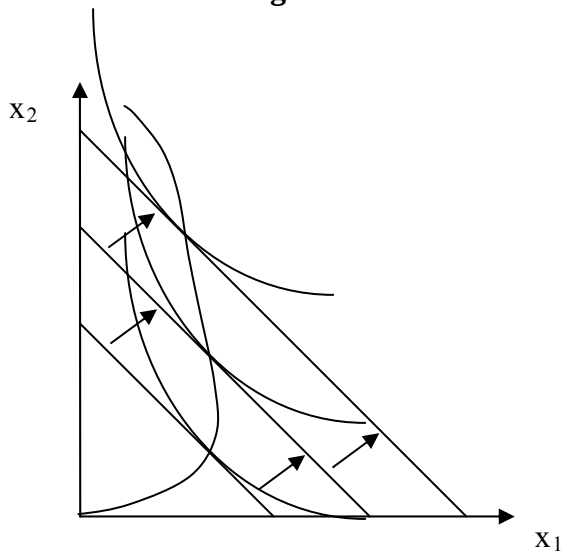
There has been some disagreement whether football is normal or an inferior good among those who have studied the demand for the sport. In this section I will briefly explain the two concepts. First, a normal good describes the case of an increase (a decrease) in consumption of the good as income increases (decreases). This can be illustrated with an extension of figure 4:

Figure 5



An increase in income implies an outward shift in the budget constraint. The tangential points which then arise are known as the *income expansion path* when a line is drawn between them. The function is called the *Engel Curve*. Second, in contrast to the normal good, the inferior good do not increase in consumption as income increases. The income expansion path then bends backward as shown in figure 6. We see that the consumer actually consume less of one of the goods (Varian, 1992).

Figure 6



In the figures above we can assume that x_1 is football and x_2 a random other good or simply rest of other consumption goods.

Many studies include macroeconomic variables, such as income and unemployment rate in a club's catchment area. Baimbridge et al. (1996) expects that the unemployment rate has a negative effect on the attendance, but the analysis concludes the opposite. Falter and Pérignon (2000) discover the same relationship in French football. This suggests that football is an inferior good. The income variable in other studies suggests however that football is a normal good. In their investigation of whether football is a normal or an inferior good, Forrest et al (2003) conclude that English Premiership football is a normal good. This is also in line with García and Rodríguez (2002) analysing the Spanish Primera Division. I also find it reasonable to assume that Tippeligaen is a normal good.

3.3 Determinants of Attendance

The main aim of this thesis is to find the impact of public broadcasted matches on the stadium attendances. There are however numerous circumstances outside the model presented above, which are reasonable to believe have an impact on the attendance. In this section I present the economic literature on the demand for sport and other relevant economic contributions. I briefly discuss it and try to relate it to the case of Tippeligaen. In line with Borland and MacDonald (2003) I have divided the determinants into five different categories. In contrast to the authors I treat the impact of Broadcasting as a sixth category instead of an economic variable. The categories are:

- Preferences
- Economic Variables
- Quality of Viewing
- Uncertainty of Outcome
- Capacity Constraints
- The Impact of Broadcasting

3.3.1 Preferences

Consumer preferences in the demand for football are in many ways equal to those for a consumer who consume other types of goods or services. That implies that utility are increasing with a decreasing rate with the quantity consumed. There are however reasons to believe that preferences may be a little bit more complex. This complexity can be related to three concepts: "Habit", "conspicuous consumption" and "bandwagon effects". Only the first one has got attention in economic demand for sport literature (Borland and MacDonald, 2003). I will in the following shortly outline the three concepts.

The *habit* hypothesis refers to (i) that the current preferences and demand are influenced by past consumption preferences and (ii) that higher consumption of a good in the past implies, *ceteris paribus*, higher present consumption of the same good (Pollak, 1970). In a demand for football model the present attendance will then influence the current attendance. This effect can be interpreted as fan loyalty. This fan loyalty can very much also be interpreted as what Becker and Murphy (1988) call addiction. They point out that people do not only get addicted to cocaine, alcohol and cigarettes, but also to any other activities such as work and music. An addicted individual may not act rational. A football fan which is addicted to football is therefore excluded from the rational choice framework. The authors include however addiction in the model of rationality.

The Norwegian-American economist Torstein Veblen (1899) introduced the concept of conspicuous consumption in his well known book "The Theory of the Leisure Class". Conspicuous consumption is therefore also referred to as the *Veblen effect* and captures the case of an increased demand of a good when the price is high rather than low. This is in conflict with rationality, but the conspicuous consumer want, from a sociological point of view, show some kind of a status by paying more rather than less. In everyday language this is formulated in the phrase "Keeping up with the Joneses." (Leibenstein, 1950). There are no

reasons to expect that the Veblen effect is widespread among consumers of football. Traditionally football is a working class sport, and the working class has not been a typical exponent of "keeping up with the Joneses". The last decade, however, has football also become popular among the financial elite and what is considered as the upper class of the society. New stadiums with exclusive VIP lounges may have increased the cases of conspicuous consumption in Norway as well as in other European football leagues.

The bandwagon effect reflects the case when a consumer will demand more (less) of a commodity at a given price because some or all other individuals in the market also demand more (less) of the commodity (Leibenstein, 1950). Translating this into the world of football, this mean that attendance by one fan, increases the value of attendance for other fans. A football fan is then not only engaged in what actually happens on the field, but he also has some preferences to what is going on in the stands. There are reasonable to believe that there exists some degree of a bandwagon effect in the demand for football and that the atmosphere in a sold out stadium is preferred to the atmosphere in a half empty one by the attendees.

3.3.2 Economic Variables

The problem of defining good price variables and the ambiguous results from different studies are already presented in section 3.2.1. In respect to this, some economists argue to leave admission price outside the demand model. Peel and Thomas (1992) and Falter and Pérignon (2000) are among those. They also base their argument on the fact that the admission price is an endogen variable, a result of several prior interactions between the demand and supply of football.

Using the admission price is, however, somehow not sufficient in measuring the consumer's cost of attending the game. As economists we are more interested in the opportunity costs. An important component in measuring this cost is the travelling cost, both money and time, of the away supporters. A normal implementation of opportunity costs in demand for sport studies is therefore to introduce a variable which measure the distance between the clubs. This is a fairly good measure for the opportunity cost although it can in some cases be cheaper to travel a route, which may is longer in kilometres than an alternative route.

Another important economic variable which is expected to have an impact on the attendance is the market size. How many possible buyers of a match ticket are there? A common used

measure for market size is population. The questions which then arise are: What population is appropriate to use for the respective clubs? What is the club's catchment area? Hart et al. (1975) used data on the male population in the urban parliamentary constituencies surrounding the club grounds. Thus, they assume that the attendance mainly consists of men. Although the majority of the attendance in Tippeligaen is men, there are a considerable proportion of women. To use the male population as a measure of market size is then not sufficient. Most studies do however not divide the population between the sexes, but they differ in the way they define the catchment area. Forrest et al. (2002) found that most of the attendees lived within 10 miles of the stadium and they argue that those who live near the place in question may feel more affinity to the club than those living further away. This also sounds reasonable in Norway, but there are probably differences between the clubs. In Oslo, for example, there are two clubs, Vålerenga and FC Lyn, which share market size. Rosenborg, on the other hand, has in many ways become the club of their county not only the city of Trondheim. In other words, using the population as a measurement is a simplification independent of how it is measured.

3.3.3 Quality of Viewing

The quality of viewing category captures variables such as the stadium facilities, weather and timing. Starting with the stadium facilities; there has been a major development in the stadiums in Europe the last decade as a result of an increased focus on security after tragedies such as the Heysel disaster in 1985 and an increased problem with hooliganism. UEFA has clearly defined criterions on the quality of the stadiums used in their tournaments. NFF has followed the strict rules.[13] Although the criterions are clearly defined and no one has any reasons to fear security problems in the Norwegian football stadiums, the stadium facilities differ between the stadiums and on each stadium. The demand for football may change in respect to those facilities.

The hypothesis suggests that a new stadium increases attendance, also called the *novelty effect* in economic literature. The fact that the Norwegian stadiums the last years have improved and attendance has risen builds up on this hypothesis. Economists in Europe have apparently not focused on this in their analysis of demand for sports; while the Americans have worked a little bit more on this in the studies of Major League Baseball. They find that the age of the stadium has a negative effect on attendance (Depken, 2000).

[13]NFF: Norsk Klubblisens versjon 2.0

Another "quality of viewing" variable is timing. This implies the impact of which time of the year, week and day the contest takes place. The timing is important in the sense that it influences the opportunity cost. If the contest or game takes place at a time when something more valuable happens from the consumer's point of view, the opportunity cost will increase and attendance decrease. The literature is quite clear about this (Borland and MacDonald, 2003). Considering the role of the opportunity cost, Forrest and Simmons (2006) finds that the lower divisions' attendance in the English league suffers from the broadcast of midweek Champions League matches. The schedule of Tippeligaen takes the role of the opportunity cost into account. Even though Norway did not take part in the world cup in Germany in 2006 and only a handful of players in Tippeligaen took part representing their respective countries, the league had a break during the championship. The next season, in 2007 when no international tournament took place, the break was in July when most employees in Norway are on vacation, which would lead to an expectation in lower attendance.

The last "quality of viewing" variable which is supposed to have some sort of impact on the attendance is the weather conditions. Temperature and precipitation may have an impact of how comfortable the spectator finds it on the stands. Clearly, the improvements of the stadiums have made it less volatile concerning the weather conditions. In a modern stadium there are ceilings above the stands and the spectators do not get wet from rainfall. The literature conveys different results on the impact of the weather conditions in respect to which sports which are in question and where the contest takes place (Borland and MacDonald, 2003). In the case of football Baimbridge et al (1996) find no significant impact from precipitation and wind in the English Premiership, while García and Rodríguez (2002) find that poor weather conditions reduces attendance significantly in Spain. The different conclusion from England and Spain may is a result of cultural differences. England has definitely another climate than Spain and the respective populations may therefore react on poor weather differently. Such differences may also be the case inside Norway. Bergen is well known for the poor weather conditions and therefore the fans of SK Brann may not react on precipitation the same way as those who would like to attend matches in the area of Oslo.

3.3.4 Uncertainty of Outcome

The determinant *uncertainty of outcome* or *competitive balance* is perhaps the must discussed topic in the demand for sport literature and economic sport literature in general. Rottenberg

(1956) was the first one to claim that games had to have some degree of uncertainty if the consumers should be willing to pay the admission price. This uncertainty does not only generate increased attendance at teams own games, but makes the whole league more interesting and attendance will increase in other games as well. In other words there is an externality. Neale (1964) gives in his classic article "The Peculiar Economics of Professional Sport" the hypothesis a name, the *Louis-Schmelling Paradox*. This paradox refers to the two heavy weight boxers Joe Louis and Max Schmelling competing for the world championship in the 1930's. With this paradox Neale confronts the monopoly theory that a firm is better off and earns higher profit if it is the sole supplier of a product. Considering, however, the situation of the world heavy weight champion, there is more profitable if there is some competition. If the heavy weight champion wants to maximize his profit he obviously needs a contender. The prize money will even rise the stronger the contender is.

Pure monopoly is disaster: Joe Luis would have no one to fight and therefore no income (Neale, 1964)

Although it is obvious that an athlete or a team needs a contender and monopoly is not preferable, it is more doubtful whether a sporting league or an association prefer a free market situation. Imagine for example a situation where there are two professional football leagues in one country. Probably one of the leagues would go bankrupt and a natural monopoly situation would soon arise. There are however a few examples that professional sport associations can compete against each other. In the professional boxing world there are three equal associations (WBA, WBC, IBF) and among the fighters it is prestigious to win all of them.

It is obviously no problem to implement the *Louis-Schmelling Paradox* in any other sport than boxing. Almost every study in demand for sport has some sort of variable measuring the uncertainty of outcome. The hypothesis predicts that uncertainty has a positive impact on demand. There is however widely discussed how to measure uncertainty, but there seem to be no strong agreements among sport economists though. It is convenient to distinguish between two types that occur subject to a sporting league; (1) *Match outcome uncertainty* and (2) *seasonal uncertainty of outcome*.

Match uncertainty refers to the uncertainty of a specific match. There are two dominating approaches to this type of uncertainty (Downward and Dawson, 2005). First, some use a measure of difference in winning percentage or league ranking of teams, a performance based

measurement. Information about the teams' performance within the current season is explicitly accounted for. Second, a measure of probability derived from betting odds. Peel and Thomas (1988) used fixed betting odds in their study. They argue that if the market of fixed odds betting is efficient, then odds posted for various outcomes of a match will be unbiased predictions of the outcome. The betting odds also fully reflect the available information when the odds are set. One critical argument of using betting odds has been that many studies show that the fixed odds offered by bookmakers is not efficient, the betting markets may be biased. Another argument is that betting odds really measure the probability of home win and not uncertainty of outcome (Downward and Dawson, 2005). Considering match outcome uncertainty, there are no clear evidence on acceptance of the hypothesis that uncertainty has a positive influence on attendance. Some studies have even shown the opposite (Borland and MacDonald, 2003)

Seasonal uncertainty of outcome reflects the position of the team in reference to the possibilities of winning the championship or the possibilities of promotion/relegation. In other words it refers to the closeness of a competition. Jennet (1984) has introduced a complex model of this type of uncertainty which is used in other studies. He points out that the attendance not only is determined by the uncertainty related to a specific match, but to the uncertainty of the league's final outcome and the race for the championship. The complexity of this issue arrives because this kind of uncertainty is more important in the end of the season than in the beginning. In Jennet's model there are two important uncertainty factors to determine whether the supporter will go to the match or not: (1) is the team in a position of winning the championship or in a possibility of relegation? (2) The number of remaining games in the season. The main critique of this model is that it is impossible to know how many points that are needed to secure the championship or avoid relegation. In Jennet's model the uncertainty is therefore calculated ex post at the end of the season.

Another such ex post measurement of uncertainty of championship outcome is introduced by Janssens and Késenne (1987) and represented in Czarnitzki and Stadtmann (2002). They construct the following index:

$$U = \begin{cases} \dfrac{100}{c-b}, & \text{if } c-b \le m-3t \\ 0 & \text{if } c-b > m-3t \end{cases} \tag{3.1}$$

c corresponds to the points needed to win the championship, *b* is the current number of points the team has and *t* is the number of games played. *m* is the maximum number of points a team can collect during the season. Thus, the variable U takes the value zero at the stage a team does not have a theoretical chance of winning the season anymore. If the league champion has the required number of points before all their matches have been played, we see that U is not defined, the denominator is zero. The authors do not discuss this case. Anyway, this will eventually happen to very few games in a sample, so setting a default value equal to 100, should not alter the result. This value corresponds to the case when a team only need one point to win the championship.

As mentioned in section 2.1, the end of the domination of Rosenborg's position in Norway has increased the uncertainty of who is going to be the winner of Tippeligaen. That other teams are able bring the league trophy back home may have had a positive influence on the attendances.

Czarnitzki and Stadtmann (2002) also present a variable which hardly can be considered as an uncertainty variable. They call the variable *reputation* and it captures the fact that some teams have a tradition and history which is thought to have an impact on the attendance. This seems plausible also in the case of Norway: Rosenborg's domination in Tippeligaen by winning 13 championships in a row has made it very prestigious for their opponents to beat them. The Reputation variable is defined:

$$REP = \sum_{t=1}^{T} \frac{n}{x_t \sqrt{t}} \quad \text{with } T = 9 \tag{3.2}$$

x_t is the team's final ranking t seasons ago. n is the total number of teams in Tippeligaen and Adeccoligaen. The weighting of the rankings over the years considered, reflects the depreciating effect on a team's reputation. The variable takes a higher variable the better reputation the team has. I have modified the model to fit into the Norwegian case. First, as mentioned, I have considered Tippeligaen and Adeccoligaen as one league, implying that in this formula number one in Adeccoligaen corresponds to a hypothetical number fifteen in

Tippeligaen, number two corresponds to number sixteen etc. Second, I have set $T=9$.[14] This is convenient because before the 1997 season, the level under the premiership division was divided into two leagues subject to geographical placement of the teams. This makes it difficult to implement earlier seasons in the model. Third, if a team did not play continuously in the two top divisions the seasons considered, the sum is set to zero.

3.3.5 *Capacity Constraints*

A stadium's capacity reflects the supply of the sport. Many studies have ignored the fact that the stadiums might be sold out. In such cases it is hard to measure the real demand for the sport, and we need to take into account that the variable is truncated. (Borland and MacDonald, 2003. Kennedy, 2003) In the case of Tippeligaen only a very small proportion of the games are sold out, so the problem will not play a crucial role in an analysis (see section 4.1.5).

3.3.6 The Impact of Broadcasting

Live coverage of football on television is probably the best alternative to actually showing up on the match if one wants to see a game. There are therefore surprisingly few studies on the impact of broadcasting, although the clubs often claim that they lose gate revenue when the games are broadcasted. The few studies on the impact of broadcasting on sport attendance are somewhat ambiguous. The studies from England find that live broadcasts either have a significant negative or zero effect (Borland and MacDonald, 2003). Baimbridge *et al*. (1996) conclude that the live coverage of the English Premier League matches in the weekends have no significant impact on the attendance. The matches broadcasted on Mondays experienced however a decline in the attendance. In the study of the Spanish Primera Division, García and Rodríguez (2002) find that broadcasting has a negative impact independently of the timing of the game. They point out that the effect is larger if the game is shown on a public channel where everybody has free access contrary to the situation where the game is shown on a subscription based channel. Falter and Pérignon (2000) find in their study of the French football league, no significant impact of broadcasting. They argue, however, that the reason is that broadcasted matches are all shown on a pay-TV channel.

When broadcasting of matches has a negative impact on the attendance there is a reason to claim that "couch viewing" is a substitute for actually showing up at the match. There are

[14] Czarnitzki and Stadtmann (2002) have set T=20, but they also point out that setting T=6 does not harm their results.

however studies, which show that live broadcast of sport events has a positive impact on attendance. In other words that a live broadcasted sport event is a compliment to the good offered at the stadium. These studies are mostly linked to US sports such as Baseball and American football. Borland and MacDonald (2003) discuss these studies. They also conclude that most studies suggest a negative impact of broadcasting on attendance on sporting contests and that there is impossible on the ground of existing empirical evidence to support a positive relationship. Further, they argue:

> Live broadcast of a match may decrease attendance at that match, but nevertheless stimulate interest in the sporting competition in a way that increases total attendance. (Borland and MacDonald, 2003)

Having figure1 in mind it is tempting to transfer the above argument into the issue of broadcast and attendance in Norwegian professional football. This argument also is logic, because it is important for the companies which buy the sporting contest that their investment pays off. If the product (in this case Tippeligaen), dramatically change by a decline in attendance, the TV-viewers and sponsors may not be interested in the televised product anymore. It is therefore in the interest of the broadcaster to maintain or even increase the attendance. Czarnitzki and Stadtmann (2002) argue in this direction when they find a positive relationship between broadcasting and attendance in their analysis of the German Bundesliga. They further conclude that they have to drop the TV variable because the TV-stations and stadium spectators based their demand on the same variables, a specification error occur.

4. Construction of the Data Set

In this section I present the data used in my analysis of demand for Norwegian top division football.

4.1 Football Statistics

Several newspapers and websites provide typical match facts of games played. The quality and credibility vary however substantially. Two websites are however sovereign in respect to the two requirements. The first one is the *RSSSF Archive*, available at www.rsssf.com.[15] The second website which delivers quality data is www.nifs.no. The website is provided by the newspaper *BA* (Bergensavisen) in cooperation with *Neco data*. I use both sources when collecting the football specific variables of interest, namely attendance, the teams' points and positions during the season, the teams' history when calculating reputation and the point of time the games are played. Data on which games that are broadcasted live on public channels are provided by TV2 on enquiry.

4.2 Uncertainty of Outcome

In my model I will both control for match outcome uncertainty and seasonal uncertainty of outcome. Starting with the uncertainty related to the match outcome I will use betting odds from Norsk Tipping AS[16] which provide odds on every premiership games.

As discussed above the odds reflect the probabilities of the three outcomes in a game; home win, draw and away win. The odds are however not expressed as probabilities as we know them from the teaching book of statistics and the betting company also sets a margin to make the business profitable. Consider the following example:

From the opening game of the 2006 season between the rivals Lillestrøm and Rosenborg Norsk Tipping offered the respective odds: 2.30 3.10 2.40. This implies that the gambler receives 2.30 times his investment if Lillestrøm wins (H), 3.10 times his investment if the game ends with a draw (D), and 2.40 times his investment if Roseborg wins (A). The first step

[15] RSSSF was founded 1994 under the name NERSSSF (Northern European Rec.Sport.Soccer Statistics Foundation)
[16] Norsk Tipping AS is a joint-stock company 100% owned by the Norwegian government.

of the calculation of the probabilities of every three outcomes is to calculate the bookmaker's profit index (PI):

$$PI = \frac{1}{odds(H)} + \frac{1}{odds(D)} + \frac{1}{odds(A)} \tag{4.1}$$

In our example the profit index is 1.174. The profit index varies between 1.173 and 1.180 in my data set. The second step of the calculation is to find the bookmaker's payout ratio. Assuming that the bookmaker receives the right share of bets on each outcome, the payout ratio (PR) is:

$$PR = 100\% \cdot \frac{1}{PI} \tag{4.2}$$

In our case the payout ratio is 85 per cent, implying that Norsk Tipping pays out 85 per cent of the gambler's stake. Now we can, in the third and last step, calculate the probabilities the bookmaker thinks reflect the outcome uncertainty of the particular game:

$$P(H) = \frac{1}{odds(H)} \cdot PR \tag{4.3}$$

$$P(D) = \frac{1}{odds(D)} \cdot PR \tag{4.4}$$

$$P(A) = \frac{1}{odds(A)} \cdot PR \tag{4.5}$$

In our example this implies that Norsk Tipping means that there is 37.0% chance of a home win, 27.5% chance of the game ending with a draw, and 35.5% chance of an away win.

As a measure of seasonal outcome I have used the model from Czarnitzki and Stadtmann (2002) presented in section 3.3.4.

4.3 Population and Distance Statistics

As discussed above there are various ways of measuring a club's market share. I have simply used the population on January 1st 2007 in the municipality the respective clubs belong to.

These data are provided by Statistics Norway. Even though I analyse the 2006 and 2007 season the population do not vary significantly over such a short period, so this single census is sufficient. One could however have considered better ways to measure the away clubs' market size. The club Stabæk comes from the fourth most populated municipality, but has on their home games the lowest average attendance over the two seasons analysed. That also includes lower average than the four clubs playing one of the two seasons in the 1.division. As already mentioned, there is one city which hosts two clubs in Norway. The capital Oslo consists of the west side club FC Lyn and the east side club Vålerenga. The latter one has undoubtedly had a larger market size the recent decades than FC Lyn, and is on a fourth place on the average attendance list the two seasons considered. FC Lyn is on an eighth place on the same list. In my analysis I divide the population of Oslo equal between the two clubs. Considering the average attendance list and the fact that Oslo also has clubs in lower divisions which share the market with the two top clubs, such a split of the market size is definitely a simplification. The population effect for the home teams are captured by a fixed effect in the model presented in chapter 5, but a measure on population is still relevant for the visiting team.

There are not that many ways to measure the distance between the clubs as there are ways to measure the market size, so this should be more or less straight forward. I have used the shortest route on the public highway as a measurement for distance between the clubs. These data are provided by the Norwegian Directorate of Public Roads (Vegdirektoratet). Since distance represents the opportunity cost of travelling to an away game, it can be argued that using distance on public roads in some cases may not is the right measurement. As low cost aeroplane companies have entered the market, aeroplane tickets on some flights have become really cheap. Since the leagues fixtures are published in December, a supporter who then orders aeroplane tickets will probably get that cheap.[17] If he also lives nearby the airport, the opportunity cost may be lower than using the public roads. In most cases, however, the lowest opportunity cost is reflected in the measurement I have used.

4.4 Weather Statistics

Collecting weather statistics from each game played in the 2006 and 2007 season is not that easy. Such data are not published in the typical match facts provided by the newspapers etc.

[17] The supporter risks in this case that the game will be rescheduled. This risk has to be included in the calculation of opportunity costs.

The Norwegian Meteorological Institute, a public weather service, has observed the weather in Norway for over a hundred years.[18] The observations are registered on the different weather stations that the institute has. These stations are of course not situated on the respective clubs' arenas, but I have used the observations on the nearest station to each stadium. I have used the temperature registered in closeness to the time each game is played. Considering precipitation, the data available vary from weather station to weather station. Some stations register precipitation many times a day, while other only does it ones a day. I have used the registered precipitation the last 24 hours, that implies precipitation from 07 a.m. at the match day to 07 a.m. the day after. Table B1 in appendix B shows which weather station I have used for each club.

4.5 Capacity Constraints

The respective teams in the sample have a capacity constraint on their stadium. There is however difficult to identify which games are sold out, because some matches have a higher attendance than the official capacity on the stadium. I have simply ignored the problems related to capacity constraints, because it plays such a small role in the Norwegian case. One should however have in mind that this may creates a downward bias in the results (Kennedy, 2003). All in all there are relatively few games, about 6.5 per cent, which have a higher or equal attendance to the official capacity.

[18] The statistics are available on http://eklima.met.no

5. The Econometric Framework

The main goal of this thesis is to find out whether live television of football on a public broadcaster has an impact on the stadium attendance. I will in this section first introduce the ordinary least square estimator (OLS), before I present the model and the results.

5.1 The Ordinary Least Square Estimator

Using the OLS method is convenient because of its properties. In the justification for that I will start presenting the five assumptions of an OLS estimator. Throughout this section I will also exemplify this theory using a simple classical linear regression model (CLR):

$$Y_i = \beta_0 + \beta_1 X_i + \varepsilon_i \qquad i = 1,...,n \tag{5.1}$$

where we assume that $Y = \ln ATT$ is the dependent variable, logarithm of attendance. Y depends on the independent variable $X = TV$, a dummy variable which take the value 1 if the game is televised on a public broadcaster. β_0 is the model's constant term and β_1 is the coefficient of X saying how much Y changes if the game is televised. ε_i is the model's disturbance term (error term) capturing all the determinants of y which are not observed.

The five assumptions of the CLR model and the OLS estimator are as follows:

1. The dependent variable is a linear function of a set of independent variables and a disturbance term, just as in the above paragraph.
2. The expectation of the disturbance term is zero: $E(\varepsilon_i) = 0$
3. The disturbance terms all have the same variance: $\text{var}(\varepsilon_i) = \sigma^2$
4. Zero covariance between any random pair of disturbance terms: $\text{cov}(\varepsilon_i, \varepsilon_j) = 0$ This implies that that the values of Y_i are statistically independent.
5. The number of observations has to exceed the number of independent variables and there cannot be any perfect linear relationship between the independent variables.

The Gauss-Markov theorem states that under the assumptions 1-5, the least squares estimators, among unbiased linear estimators, have minimum variance. We say that they are best linear unbiased estimators (BLUE) (Kennedy, 2003. Gujarati, 1995. Hill et al, 2001).

5.2 Model Specification

The simple regression model presented in the above section may create biased estimates as there is reasonable to believe that assumption 1-5 is not fulfilled. TV is not assumed to be the single determinant of attendance, leading us to an omitted variable problem, implying $E(\varepsilon_i) \neq 0$. To estimate the impact of public broadcasting of matches on attendance one therefore also has to control for other effects such that $E(\varepsilon_i | controls) = 0$. Assuming this and that the remaining assumptions in section 5.1 still are a valid specification allowing for differential effects on the public channels, the model with full set of controls can be summarized as follows:

$$\ln ATT_{it} = \beta_0 + \beta_1 TV2_{it} + \beta_2 ZEBRASUN_{it} + \beta_3 ZEBRAMON_{it} + \gamma \mathbf{C} + \eta_{it} + \varepsilon_{it} \qquad (5.2)$$

η_{it} denote the home team season fixed effects that control for all factors that are home team specific and home team-season specific. ***C*** is a vector specifying the set of control variables. Furthermore we then assume that $E(\varepsilon_{it} | \mathbf{C}, \eta_{it}) = 0$ and that the assumptions 1-5 are fulfilled.

Specifying the model such that team*season effects are taken into account helps us control for the home teams' specific characteristics. Among those characteristics are market size, admission price, macroeconomic factors, reputation, fan loyalty etc. The model also allows for different fixed team effects each season, such that potentially changes in stadium facilities from the 2006 to the 2007 season.

The logarithm of attendance is (log *ATT*) is the dependent variable and β_0 is the model's constant term. In the model, which I am about to explain, all categories of variables discussed in chapter 3 are included.

The first three variables are three dummy variables reflecting whether a game was broadcasted live on a public channel or not. TV2 takes the value one if a game was broadcasted on TV2. ZEBRASUN takes the value one if a game is broadcasted on TV2Zebra on a Sunday or on a day where the majority of the round's games are played exactly at the same time as the game televised on the channel. ZEBRAMON reflects the game broadcasted on TV2Zebra on Mondays or at a time when no other games in the league are played. The subscription based channel act as the reference variable. As we assume that watching a game

on television is a substitute to show up on the stadium, the coefficients β_1, β_2 and β_3 are expected to be negative. In the model I have not taken into account that the proportion of people that are able to receive the TV2Zebra has risen with almost 20 per cent points.

As there is reasonable to believe that television is not the single determinant of the stadium attendance, the remaining variables in the model control for other time varying effects which are thought to have an impact on the number of supporters showing up on a game. These variables are captured in the vector ***C*** and include all categories of variables presented in chapter 3. The γ is the variables' set of parameters. The rest of this section presents the different variables included in the vector ***C***.

The variable ($\ln(\frac{POPA}{DIST})$) is an economic variable which captures the opportunity cost of attending a game for the away supporters. It is formulated as the logarithm of the away team's population divided by the distance between the two teams. This variable is expected to be positive, implying that the away team's population has a positive impact on attendance, while the distance has a negative impact. The interpretation of the coefficient can then be formulated as a one per cent increase in $\frac{POPA}{DIST}$, implies a γ_i per cent increase in attendance. For the four clubs situated in the area in and round Oslo, the distance is set to one.[19] This captures potential derby effects.

The next seven variables in the model are all different ways to measure match and seasonal uncertainty. The two first ones (POSH and POSA) are the home and away teams' current position before the game is played. Those are both expected to be negative, implying that teams fighting for the top positions attract more audience. The two first rounds of the season the values take the last season's final position. The two promoted teams take the values 15 and 16 as if Addecoligaen was a continuation of Tippeligaen. Further are the two variables (PH) and (PHSQ) supposed to capture the match uncertainty and are the probability of home wins, calculated as described in section 4.1.2. The probability is expected to be negative subject to the hypothesis that the match's closeness has a positive impact on attendance. The squared probability captures the likely quadratic relationship between attendance and uncertainty of outcome, thus this coefficient is expected to be positive. (UH) and (UA) are the

[19] The four clubs are: FC Lyn, Vålerenga, Lillestrøm SK, Stabæk

seasonal uncertainties as described in section 3.3.4. They are expected to have a positive relationship to attendance. In the data set, there is one observation where the denominator of U is zero. As argued above I have set this observation equal 100. Setting different values do not alter the results. There is reasonable to believe that matches are more exiting as the league goes towards its end. A trend variable (PLAYED), which measures the amount of games the home team has played, is then supposed to be positive. The model also includes the reputation variable for the away team, (REPA), where the teams' performance the last nine years is taken into account. As explained above, this takes higher value the better reputation the team has, implying that the variable's expected coefficient is positive. The interpretation of these coefficient is a unit change in the variable, implies a γ_i per cent change in attendance.

Besides (PLAYED), which also can be considered as a "quality of viewing variable", two dummy variables are included in the model reflecting the day of the week the game is played. Here I have treated Sundays and public holidays as equal days and the variable is reference to the two dummy variables Saturday (SAT) and Weekday (WEEK). Both coefficients are expected to be negative, because Sunday is traditionally the "day of football" in Norway. Thus, games played on days deviating from Sundays, the potential audience has a higher opportunity cost. (16MAY) captures the effect of the traditional round played May 16th every season. The day before the Norwegian national day is considered to be the national day of Norwegian football. The next five variables (MAY, JUNE/JULY, AUGUST, SEPTEMBER, OCT/NOV) are all dummy variables reflecting which month a game is played. The opening month April acts as reference variable. The two summer month June and July are treated as one month since the league took its holiday in July in the 2006 season and in June in the 2007 season. October and November are also one variable as only the last round of the respective seasons is played in November. As the league goes towards its end I expect positive coefficients on the last months.

(COLD) and (RAIN) are two dummy variables reflecting the weather. (COLD) takes the value 1 if it colder than 10ºC and (RAIN) the same value if there has been falling more than 10mm the 24 hours considered. Using more than 10mm has a limit also raises the probability of precipitation when the match is actually played.

5.3 Descriptive Statistics

The descriptive statistics of the variables used in the model are presented in table 1, while descriptive statistics on each home team are presented in table 2.

Table 1: Descriptive Statistics All Games 2006-2007

	No. Obs.	Mean	Std. Dev	Min	max
ATT	364	9812.2	4986.1	2563	22330
TV2	364	0.14560	0.35319	0	1
TV2ZEBRASUN	364	0.13462	0.34178	0	1
TV2ZEBRAMON	364	0.13736	0.34470	0	1
POSH	364	7.6621	4.0985	1	16
POSA	364	7.3819	4.0581	1	16
PH	364	0.43784	0.10788	0,18911	0.73892
PHSQ	364	0.20331	0.10006	0,03576	0.54600
UH	364	1.8824	3.1459	0	33.33333
UA	364	2.672	9.2058	0	100
PLAYED	364	12.495	7.5067	0	25
REPA	364	24.739	23.789	0	120.8307
SAT	364	0.11264	0.31658	0	1
WEEK	364	0.20055	0.40096	0	1
16MAY	364	0.038462	0.19257	0	1
MAY	364	0.19231	0.39466	0	1
JUNE/JULY	364	0.22527	0.41834	0	1
AUGUST	364	0.12088	0.32644	0	1
SEPTEMBER	364	0.13187	0.33881	0	1
OCT/NOV	364	0.17582	0.38119	0	1
COLD	364	0.28022	0.32644	0	1
RAIN	364	0.12088	0.44972	0	1
POPA	364	114725	85598	24254	274309
DIST	364	524.06	517.06	1	1990

Table 2: Descriptive Statistics on Home Teams

Club	No. Obs.	Mean	Std.Dev	Min	Max
Rosenborg BK	26	19672	1804.3	15897	22330
SK Brann	26	16991	1166.1	13738	19254
Viking	26	14879	1552.2	11351	16600
Vålerenga	26	13855	3652.7	8457	20703
Aalesund FK	13	10125	1271.8	6012	10780
Fredrikstad FK	26	9908	2107.2	6342	12800
IK Start	26	9444	2259.6	6116	14448
Lillestrøm SK	26	8817	1730.6	6205	11610
FC Lyn	26	7652	4051.2	2563	20152
Strømsgodset	13	6808	934.0	5347	8198
Molde FK	13	6227	1309.8	4351	9215
Sandefjord	26	5710	1187.0	3722	8103
HamKam	13	5506	1030.7	4082	8063
Tromsø	26	5561	1062.4	4007	7764
Odd Grenland	26	5276	1082.5	4021	9022
Stabæk	26	5275	904.2	3917	6907

Looking first on the minimum and maximum attendance we see that the attendance varies considerably across the two seasons analysed. That there is such a variation in the number of spectators, justifies an analysis on the demand for the sport. Considering for example the average attendance on the games played May 16th, the number of spectators is on average almost 3000 higher. The attendance also varies remarkably between teams, indicating that which team playing on own ground is of importance.

When it comes to the day of the week the game is played, about 11 per cent of the games were played on Saturdays, 20 per cent were played on Mondays to Fridays, and the remaining 69 per cent of the games on Sundays or public holidays.

152 games were covered live on the two public channels the two seasons analysed and TV2Zebra broadcasted almost twice as many games as TV2. 49 games fall under the category of ZEBRASUN, while 50 games fall under the category of ZEBRAMON. Among all public televised games about 12 per cent were between teams in top four positions and in about 56 per cent of the games one of the playing teams was among the top four. In other words was 68 per cent of the public televised games involving teams fighting for the league trophy. Looking at the bottom part of the league table, about 6 per cent of the games broadcasted live were between teams in the four lowest positions, while 47 per cent involved one of the teams fighting against relegation. The interpretation of these descriptive statistics on public televised games should however be taken with a pinch of salt, because of teams' better chances of improving their league position at the beginning of the season. Anyway, the data shows that the teams' current positions are of importance in the TV-station's choice of which games to broadcast.

The average temperature the two seasons considered was 12.7ºC, while there were 102 observations where the temperature was lower than 10ºC. The average precipitation was 3.4 millimetre. It was registered precipitation on 213 match days, and the average rainfall those days was 5.9 millimetres. There are 85 observations where the precipitation is more than 5 millimetres and 44 observations on more than 10 millimetres. 9 of those 44 observations are from Bergen, well known for its heavy rainfalls.

Among the sixteen clubs in the data set four clubs received a value zero on the reputation (REPA) variable, implying that four clubs did not play continuously in the two top divisions from 1997. Rosenborg both years has the maximum value of the variable, which is not surprising when we know how they have dominated the Norwegian league football.

The clubs' market size also varies a lot. HamKam, situated in the town Hamar, has the lowest population, while the two clubs in Oslo both has the largest market size even though the city's population is divided between the two teams. The distance variable is maximized between the two clubs Tromsø IL and Viking.

Four of the teams only have 13 home games in the data set. HamKam and Molde FK relegated from Tippeligaen after the 2006 season, while Aalesund FK and Strømsgodset replaced the two teams in the 2007 season after they promoted from Adeccoligaen.

In appendix C the descriptive statistics are divided into the four TV categories; TV2, ZEBRASUN, ZEBRAMON and the games not broadcasted on public television, we see that the games broadcasted on the two public channels have a higher average attendance than the average attendance of the total games played. The mean position of the teams also is slightly higher in the games broadcasted on public TV. This is particularly the case in the games broadcasted on TV2. The away team's reputation also has a considerable higher average value on TV2 than in the other games. All this coincides with TV2's policy and the argument of Johnsen and Solvoll (2007) presented in section 2.2.4.

The descriptive statistics clearly give some hints on what we can expect in the regression analysis presented in the next chapter, but first and foremost they present us for what methodological challenges we are facing.

6. Results[20]

The results are displayed in table 2. The table displays results from seven regressions with various number of variables used. I start with a simple model by only including the TV-variables, before I add the different categories of other variables to control other effects which may have an impact on the attendance.

Regression (1) does not control for any other variable. We see that the proportion of the variance in the dependent variable explained by the variance in the independent variables, R^2, is 13 per cent. We also see that all three TV-variables have a significant positive impact on the attendance, contrary to the hypothesis that football on public TV reduces attendance. The coefficients also take a high value. That people attend matches just because they are televised sounds unreasonable. This is therefore more likely to reflect the fact that the public broadcaster has an incentive to televise games which people would like to attend. The interpretation of the dummy coefficients is given by Halvorsen and Palmquist (1980) and Kennedy (1981) briefly presented in appendix D. In the subsequent regressions I have added the different categories of variables.

In the next regression, specification (2), the home team fixed effects are added. The R^2 increases to over 85 per cent, indicating that the observable and unobservable characteristics related to the home teams are of major importance. These characteristics are, *inter alia*, economic determinants such as admission price and market size. They also capture reputation and stadium facilities. In addition it is reasonable to believe that a team can have popular and entertaining players or other team qualities that attract more spectators during a season. Fixed irrational preferences during a season related to "habit", "conspicuous consumption" and "bandwagon" effects are unobservable variables which also will be taken into account through the fixed effect specification. The coefficients of the TV-variables are drastically reduced by the introduction of the fixed effects. Their respective t-values also get reduced; the zebra games loose their significance, while TV2 still is significant at a one per cent level. This indicates that teams which have a high attendance also are televised on a public broadcaster.

[20] In my regression analysis I have used the software package PcGive10.

Table 2: Regression Results

Dependent variable LNATT	(1)		(2)		(3)		(4)		(5)		(6)		(7)	
	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
Constant	8.92923	279	9.82677	236	9.6525	205	10.0626	49.9	10.1868	50.3	10.1820	50.3	10.1660	53.2
TV-variables														
TV2	0.489965	6.86***	0.145077	4.38***	0.0799	2.30**	0.0569	1.70*	0.0630	1.88*	0.0624	1.87*	0.0598	1.85*
ZEBRASUN	0.263275	3.57***	0.0502318	1.52	0.0488	1.53	0.0369	1.21	0.0355	1.18	0.0378	1.25	0.0355	1.19
ZEBRAMON	0.227243	3.11***	0.0475778	1.46	0.0249	0.782	0.0072	0.235	-0.0139	-0.308	-0.0221	-0.488	0.0065	0.217
Uncertainty variables														
POSH					-0.0077	-1.82*	-0.0054	-1.33	-0.0063	-1.57	-0.0066	-1.65*	-0.0065	-1.67*
POSA					-0.0038	-1.19	-0.0015	-0.494	-0.0014	-0.449	-0.0010	-0.332		
PH					-1.1712	-1.47	-1.5248	-2.00**	-1.8979	-2.47**	-1.9329	-2.52**	-1.8952	-2.60***
PHSQ					1.0749	1.32	1.5284	1.96**	1.9040	2.42**	1.9162	2.44**	1.8159	2.38**
UH					-0.0014	-0.318	-0.0019	-0.459	-0.0014	-0.331	-0.0008	-0.195		
UA					0.0018	1..31	0.0020	1.49	0.0017	1.31	0.0017	1.26		
PLAYED					-0.0001	-0.099	-0.0004	-0.326	-0.0039	-0.567	-0.0021	-0.306		
REPA					0.0016	2.72**	0.0014	2.43**	0.0014	2.48**	0.0013	2.33**	0.0013	2.39**
Economic variables														
LN(POPA/DIST)							0.0338983	5.77***	0.0337	5.82***	0.0344	5.90***	0.0342	6.00***
Timing														
SAT									0.0043	0.130	0.0026	0.077		
WEEK									0.0373	0.878	0.0435	1.01		
16MAY									0.1488	2.25**	0.1348	1.98**	0.1796	3.26***
MAY									-0.0942	-2.00**	-0.0907	-1.91*	-0.0701	-2.66***
JUNE/JULY									-0.0230	-0.304	-0.0250	-0.327		
AUGUST									0.0225	0.213	0.0167	0.158		
SEPTEMBER									-0.0195	-0.152	-0.0330	-0.258		
OCTOBER									0.0702	0.459	0.0444	0.290		
Weather														
COLD											0.0239	0.904		
RAIN											-0.0519	-1.65*	-0.0537	-1.78*
Home team*season fixed effects	NO		YES		YES		YES		YES		YES		YES	
	R^2=0.1312 No. obs: 364 No. parameters: 4		R^2= 0.8523 No. obs: 364 No. parameters: 30		R^2= 0.8698 No. obs: 364 No. parameters: 38		R^2= 0. 8813 No. obs: 364 No. parameters: 39		R^2= 0. 8889 No. obs: 364 No. parameters: 47		R^2= 0. 8900 No. obs: 364 No. parameters: 49		R^2= 0. 8856 No. obs: 364 No. parameters: 38	

***significant at a 1 per cent level

**significant at a 5 per cent level

*significant at a 10 per cent level

Adding the uncertainty variables in specification (3) reduces the significance of TV2 to a five per cent level and the coefficient is also reduced. This indicates that the close and exciting games also are televised. This is natural as these games probably also attracts higher audience in front of the television. At this stage of the analysis only two uncertainty variables have significant impacts. The position of the home team (POSH) has the expected sign and is significant at ten per cent level. The position of the away team also has a negative coefficient, but it is not significant. The next five uncertainty variables do not play a significant role. Reputation of the away team (REPA) is positive and significant at five per cent level. The away team's performance in the league over time has created expectation and prestige among the spectators and attracts more people to the stadiums.

The introduction of the economic variable in specification (4) captures the opportunity cost of the away supporters. We see that the positive impact of live coverage of games is further reduced. The TV2 variable is now significant only at the ten per cent level. The economic variable has the expected sign and a high level of significance, implying that the away team's population and the distance between the clubs are important factors in the determination of attendance. Controlling for the economic variable also changes the impact of the uncertainty variables. Both the home and away team's position still plays an insignificant role. The uncertainty related to the match outcome plays however an important role, (PH) has the expected negative impact on the attendance. The relationship between attendance and home win probability is also U-shaped. The reason for this is likely to be that the variable not only is a measure on uncertainty, but also measure on the probability of number of goals scored (Peel and Thomas, 1992)[21]. A team which scores frequently are more likely to attract people to the games than those which do not score that often. Neither the seasonal uncertainty nor the stage of the competition has surprisingly any significant impact on the attendance. Although the away team's position does not seem to have any impact on the attendance, the reputation (REPA) of the away team still seems to have a positive influence.

The next two regressions, specification (5) and (6), include time variables and weather variables ("quality of viewing") respectively. Controlling for these variables, we see that the TV-variables do not change the results dramatically. This is not surprising as timing variables and weather typically not is correlated with TV coverage. The ZEBRAMON variable gets

[21] Czarnitzki and Stadtmann (2002) argue that this explanation lacks credibility.

negative, but it is still not significant. Specification (6) is the completely specified model with all variables presented in section 5.2 included. In the full specified model the variables of significant importance in the previous regressions still are significant. In addition we see that the probability that the home teams position (POSH) plays a negative role in the determination of attendance increases. The variable is significant at a ten per cent level. The fact that we do not see the same tendency in the case of the away team (POSA) is not surprising as the away supporters normally are a small minority of hard core fans in the stadiums. The hard core fans showing up at the away games have a strong loyalty to their clubs and may fall under addiction concept to Becker and Murphy (1988) presented in section 3.1.1. Rain has the negative impact and same level of significance in the completely specified model. May 16th has a positive influence on attendance at a five per cent level, while the month of May attract less people to the stadiums.

The last result presented in table 2 is specification (7). Here I have excluded all variables with level of significance lower than ten per cent in specification (6). This does not change the TV variables significantly. We also see that the other control variables do not change dramatically. The signs are the same as in regression (6) and they have a relatively low level of significance. The value of R^2 is also just slightly reduced, with less than one percentage point.

6.1 Discussion

With the substantial set of control variables available, the TV variables do not get the expected negative sign. At first sight this seems a little bit unreasonable. As long as TV is assumed to be a substitute those effects should be negative. Thus, there may be a misspecification in the model, implying that a relevant unobservable variable is omitted. The definitions of the different variables are also a debatable point. Sport economists have particularly spent a lot of time on finding convenient measures on the different uncertainty variables. In other words, caution most be expressed when interpreting the results.

By omission of a relevant independent variable, the disturbance of the misspecified equation will not have a constant zero mean, implying a violation of the second assumption of the OLS estimator presented in section 5.1. Kennedy (2003) argues, however, that this should be viewed as a violation of the first assumption that the dependent variable is a linear function of known independent variables. If the omitted variable is correlated with the included

independent variables, the OLS estimator of the coefficients will be biased. If the omitted variable is uncorrelated, only the intercept estimator is biased.

Moreover, the results clearly do not support the hypothesis that live televised football games on public broadcasters reduce stadium attendance. Even though live broadcasting is a substitute of showing up in person, it will never be a perfect substitute. The couch and the stands are not equal. We also know that the broadcaster wants to maximize its audience and therefore have to advertise the broadcasted sport events. This is also likely to function as advertising for the game itself, and not only the program that broadcasts it. Therefore the attendance also increases at the stadium when the game is broadcasted. This is in the interest of both the broadcaster, which wants a good production with a full and noisy stadium, and the football club which wants to maximize the gate revenue.

7. Conclusion

In this thesis I have discussed and analysed the demand for Norwegian premiership football. I have particularly looked at the role of television after NFF's historical sale of rights to the TV2 Group and Telenor. There is a clear interdependence between the sport and the media, where both actors have the interest of increasing demand. There is however reason to believe that some of the potential spectators who got the opportunity of "couch viewing" will in some cases drop out of the stadium and stay home in the couch watching the game on television. In other words that television viewing is a substitute of showing up at the game.

In my analysis I find no evidences that live covered games on a public broadcaster from the Norwegian premiership act as substitutes to showing up at the stadiums in person. In other words there is difficult to argue that the clubs lose gate revenue when games are televised by a public broadcaster. At least, the loss is more that offset by the transfer of money the TV-agreement has generated. There are however many variables that are thought to have an impact on the attendance. Preferences, economic variables, "quality of viewing", uncertainty of outcome and capacity constraint are all factors that I have outlined and discussed. In other words, there is a complex reality out there and an analysis will anyway be simplicities of the actual facts. I have however pointed out what factors which apparently are of importance.

Most of the determination seems to be dependent of factors related to each single team. It should therefore be in the interest of the league itself and economists to analyse which properties related to the teams that are of importance in the determination of the number of spectators. Knowledge about that may improve the club's ability to generate more income from gate revenue, which further gives the clubs a potential to develop further in the crave for the championship trophy and success in European cups.

Furthermore should the league be careful in disrupt the competitive balance by making the financial differences between the clubs larger through TV agreements. We may not have seen the consequences of the current agreement in relation to this yet, but the policy makers should have this in mind when negotiating future agreements.

The 1 billion NOK TV contract also included the opportunity to broadcast Tippeligaen over the internet and cellular phones. It was possible for the costumers against payment to watch the league through those interactive media the two seasons just analysed. This analysis has however not taken this new phenomenon into account when estimating the demand for Norwegian football. This is however a growing market, which should be taken into considerations in future analysis.

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Appendix A: Abbreviations

EU – the European Union

IBF – International Boxing Association

NFF – Norges Fotballforbund / Norwegian Football Association

NIFS – Norsk og Internasjonal Fotballstatistikk / Norwegian and International Football Statistics

NRK – Norsk Rikskringkasting / the National Norwegian Broadcasting Corporation

NTF - Norsk Toppfotball / the Assocation of Norwegian Top Division Clubs

RSSSF - Rec.Sport.Soccer Statistics Foundation

UEFA – the Union of European Football Associations

WBA – Wold Boxing Association

WBC – Wold Boxing Council

Appendix B: Weather Statistics

Table B1 shows which weather station I have used to the respective clubs.

Table B1

Club	Municipality	Weather station (Municipality)
Aalesund FK	Ålesund	Vigra (Giske)
SK Brann	Bergen	Flesland (Bergen)
Fredrikstad FK	Fredrikstad	Sarpsborg (Sarpsborg)
HamKam	Hamar	Stavsberg (Hamar)
Lillestrøm	Skedsmo	Blindern (Oslo)
FC Lyn	Oslo	Blindern (Oslo)
Molde FK	Molde	Hjelvik-Myrbø (Rauma)
Odd Grenland	Skien	Kongsberg Brannstasjon (Kongsberg)
Rosenborg	Trondheim	Trondheim - voll (Trondheim)
Sandefjord	Sandefjord	Melsom (Stokke)
Stabæk	Bærum	Blindern (Oslo)
IK Start	Kristiansand	Kjevik (Kristiansand)
Strømsgodset IF	Drammen	Kongsberg Brannstasjon (Kongsberg)
Tromsø IL	Tromsø	Tromsø (Tromsø)
Viking	Stavanger	Sola (Sola)
Vålerenga	Oslo	Blindern (Oslo)

Appendix C: More Descriptive Statistics

Table C1–C4 displays the descriptive statistics on the observations divided in respect to the four TV categories: TV2, ZEBRASUN, ZEBRAMON and non-public TV (subscription TV).

Table C1: Tv2

	No. Obs.	Mean	Std. Dev	Min	max
ATT	53	13502	5286.9	4264	21901
POSH	53	5.8868	4.2456	1	14
POSA	53	5.0566	4.0782	1	14
PH	53	0.41599	0.097859	0.28323	0.679583
PHSQ	53	0.18244	0.090429	0.08022	0.46183
UH	53	3.0657	5.5895	0	33.33333
UA	53	2.9263	2.8352	0	14.28571
PLAYED	53	12.340	7.5293	0	25
REPA	53	38.234	24.197	0	120.8307
SAT	53	0.037736	0.19238	0	1
WEEK	53	0.094340	0.29510	0	1
16MAY	53	0.037736	0.19238	0	1
MAY	53	0.20755	0.40943	0	1
JUNE/JULY	53	0.22642	0.42252	0	1
AUGUST	53	0.11321	0.31988	0	1
SEPTEMBER	53	0.13208	0.34181	0	1
OKT/NOV	53	0.16981	0.37906	0	1
COLD	53	0.28302	0.45478	0	1
RAIN	53	0.15094	0.36142	0	1
POPA	53	162712.9	90988.	27909	274308.5
DIST	53	454.79	401.54	1	1810

Table C2: ZEBRASUN

	No. Obs.	Mean	Std. Dev	Min	max
ATT	49	10998	4835.2	2563	21146
POSH	49	7.8367	4.2148	1	14
POSA	49	7.1837	4.0346	1	14
PH	49	0.45280	0.11917	0.274681	0.738916
PHSQ	49	0.21894	0.11538	0.07545	0.546
UH	49	1.5108	1.3245	0	4.545455
UA	49	1.6800	1.6240	0	6.66667
PLAYED	49	12.653	7.7178	0	25
REPA	49	17.588	13.001	0	48.77051
SAT	49	0.040816	0.19991	0	1
WEEK	49	0.081633	0.27664	0	1
16MAY	49	0.040816	0.19991	0	1
MAY	49	0.18367	0.39123	0	1
JUNE/JULY	49	0.20408	0.40721	0	1
AUGUST	49	0.12245	0.33120	0	1
SEPTEMBER	49	0.14286	0.35355	0	1
OKT/NOV	49	0.18367	0.39123	0	1
COLD	49	0.22449	0.42157	0	1
RAIN	49	0.16327	0.37344	0	1
POPA	49	95789	76590	24254	274309
DIST	49	499.20	498.41	1	1990

Table C3: ZEBRAMON

	No. Obs.	Mean	Std. Dev	Min	max
ATT	50	10398	4771.2	4473	21398
POSH	50	7	4.3425	1	14
POSA	50	7.9	4.2964	1	15
PH	50	0.44451	0.12548	0.189113	0.680607
PHSQ	50	0.21302	0.11426	0.03576	0.46323
UH	50	2.5124	2.6795	0	16.66667
UA	50	1.9452	2.1277	0	12.5
PLAYED	50	11.94	6.8940	0	23
REPA	50	27.841	25.048	0	120.8307
SAT	50	0.1	0.30305	0	1
WEEK	50	0.86	0.35051	0	1
16MAY	50	0	0	0	0
MAY	50	0.16	0.37033	0	1
JUNE/JULY	50	0.26	0.44309	0	1
AUGUST	50	0.16	0.37033	0	1
SEPTEMBER	50	0.14	0.35051	0	1
OKT/NOV	50	0.12	0.32826	0	1
COLD	50	0.22	0.41845	0	1
RAIN	50	0.060000	0.23990	0	1
POPA	50	126275.7	90101	24254	274309
DIST	50	433.94	456.04	1	1965

Table C4: NON-PUBLIC TV

	No. Obs.	Mean	Std. Dev	Min	max
ATT	212	8477.5	4434	3620	22330
POSH	212	8.2217	3.8494	1	16
POSA	212	7.8868	3.8152	1	16
PH	212	0.43827	0.10291	0.20263	0.72604
PHSQ	212	0.20263	0.094665	0.04106	0.52714
UH	212	1.3756	1.3722	0	0.83333
UA	212	2.5499	9.8634	0	100
PLAYED	212	12.627	7.6343	0	25
REPA	212	22.287	24.082	0	120.8307
SAT	212	0.15094	0.35884	0	1
WEEK	212	0.099057	0.29945	0	1
16MAY	212	0.047170	0.21250	0	1
MAY	212	0.19811	0.39952	0	1
JUNE/JULY	212	0.22170	0.41637	0	1
AUGUST	212	0.11321	0.31760	0	1
SEPTEMBER	212	0.12736	0.33416	0	1
OKT/NOV	212	0.18868	0.39218	0	1
COLD	212	0.30660	0.46217	0	1
RAIN	212	0.11792	0.32328	0	1
POPA	212	104380.8	80897	24254	274309
DIST	212	568.38	557.63	1	1990

Appendix D: Interpretation of Dummy Variables

The interpretation of dummy variables in semilogarithmic equations is not that straight forward as for other variables, so care most be taken when interpreting them. The following interpretation is given by Halvorsen and Palmquist (1980) and Kennedy (1981):

Let ĉ be the estimate of the dummy variable coefficient c. The percentage effect of that dummy variable is then not 100ĉ. ĉ is however an estimate of $c = \ln(1+g)$ where 100g is the correct measure on the percentage effect of the dummy variable. The expression of g is given by Kennedy (1981):

$$g^* = \exp\left(\hat{c} - \frac{1}{2}\hat{V}(\hat{c})\right) - 1 \quad \text{where } \hat{V}(\hat{c}) \text{ is an estimate of the variance of ĉ.}$$

Using this estimate on the percentage impact of live broadcasted games on attendance, we get the following results in the seven regressions presented:

Table D1: Impact of Public Broadcasting on Attendance

	Regression 1			Regression 2		
	TV2	ZEBRASUN	ZEBRAMON	TV2	ZEBRASUN	ZEBRAMON
ĉ	0.489965	0.263275	0.227430	0.145077	0.050232	0.047578
$\hat{V}$	0.005107	0.005439	0.005351	0.001098	0.001088	0.001088
g	0.628097	0.297651	0.252015	0.155494	0.050943	0.048171
% impact	62.8097	29.7651	25.2015	15.5494	5.0943	4.817125
	Regression 3			Regression 4		
	TV2	ZEBRASUN	ZEBRAMON	TV2	ZEBRASUN	ZEBRAMON
ĉ	0.079888	0.048838	0.024886	0.056924	0.036873	0.007182
$\hat{V}$	0.001211	0.001013	0.001013	0.001118	0.000925	0.000931
g	0.082510	0.049518	0.024679	0.057984	0.037081	0.006740
% impact	8.2510	4.9518	2.4679	5.7984	3.7081	0.6740
	Regression 5			Regression 6		
	TV2	ZEBRASUN	ZEBRAMON	TV2	ZEBRASUN	ZEBRAMON
ĉ	0.062970	0.035504	-0,013878	0.062429	0.037787	-0.022143
$\hat{V}$	0.001118	0.000906	0.000906	0.001114	0.000908	0.000908
g	0.064400	0.035673	-0.014785	0.063826	0.038039	-0.022905
% impact	6.4300	3.5673	-1.478462	6.3826	3.8039	-2.2905

	Regression 7		
	TV2	ZEBRASUN	ZEBRAMON
ĉ	0.059836	0.035519	0.006466
$\hat{V}$	0.001049	0.000886	0.000886
g	0.061107	0.035698	0.006040
% impact	6.110566	3.5698	0.6040